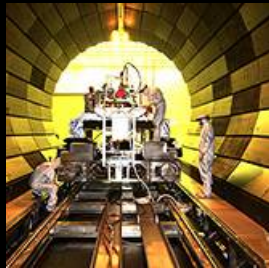
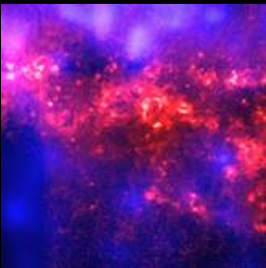
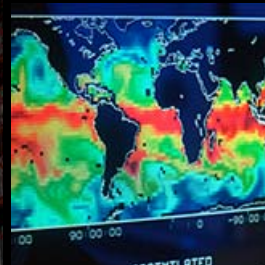


# Marshall Space Flight Center

## Gateway to America's Return to the Moon



*Presenter's Name*  
*Presenter's Title*  
*Presentation date*





# **Marshall Space Flight Center Vital to NASA's Mission**

**To pioneer the future in space exploration, scientific discovery, and aeronautics research.**

***Marshall is a key national asset creating the future of space exploration***

# NASA's Strategic Goals

- Fly the space shuttle as safely as possible until its retirement.
- Complete the International Space Station, accommodating international partner commitments and human exploration.
- Develop a balanced overall program of science, exploration, and aeronautics consistent with the new focus on human exploration.
- Bring a new Crew Exploration Vehicle into service.
- Encourage partnerships with the emerging commercial space sector.
- Return to the moon and make it a base for later missions to Mars and beyond.

***Marshall crucial to achieving NASA's strategic goals***

# Marshall's Role in Achieving NASA Missions

## Systems developer and integrator for exploration and scientific missions

- Propulsion and space transportation systems
- Scientific spacecraft and complex space systems
- Scientific research and instrument development



***Applying expertise in systems development and integration***



# Marshall Space Flight Center at a Glance

- **Employees:** 7,000 (2,570 Civil Service; 4,430 contractor)
- **Location:** 1,841 acres on Redstone Arsenal, Huntsville, Alabama
- **Buildings:** 237 with 4.5M sq ft of space
- **One-of-a-kind facilities:** 50
- **Nearby resources:**
  - National Space Science & Technology Center
  - Cummings Research Park
  - Alabama A & M University
  - University of Alabama - Huntsville
  - U.S. Space & Rocket Center

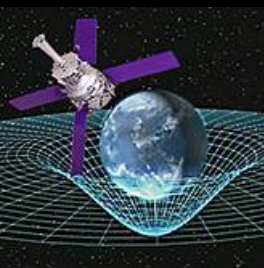


- \$2.2B budget
- Part of NASA's nearly \$1B annual Alabama impact
- Payroll since 1960: \$6.1B
- Engages 20,800 people in 47 states
- Manages Michoud Assembly Facility near New Orleans



# Marshall Historical Highlights 1960–2006

- 2006— *Discovery* launches on July 4<sup>th</sup>
- 2006— Delivers ISS Oxygen Generation System
- 2006— New Horizons probe to Pluto launched
- 2006— Stardust returns comet dust to earth
- 2005— Begins work on Ares I launch vehicle
- 2005— *Discovery* returns space shuttle to flight
- 2004— Gravity Probe B launched
- 1999— Chandra X-Ray Observatory launched
- 1995— Space Shuttle-MIR rendezvous
- 1990— Hubble Space Telescope launched
- 1988— Begins work on ISS
- 1981— America's first Space Shuttle
- 1975— Apollo-Soyuz test project
- 1973— Skylab, 1<sup>st</sup> U.S. space station
- 1969— Saturn V boosts humans to the Moon
- 1960— Wernher von Braun first MSFC Director



# Marshall Program, Project and Activity Snapshot

## Gateway for returning America to the moon

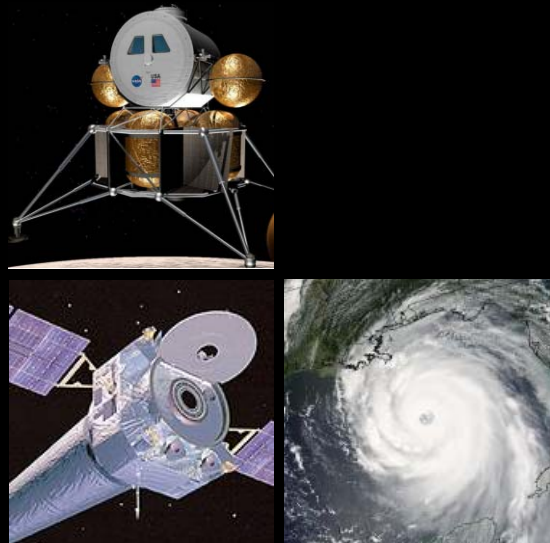
- Ares I crew launch and Ares V cargo launch vehicles projects
- Lunar Precursor Robotic Program
- Lunar Lander Project including Lunar Surface Access Module

## Engineering and program management excellence

- Space shuttle propulsion
- International Space Station element integration
- Chandra X-Ray Observatory and Gravity Probe B programs
- Discovery and New Frontiers exploration programs

## Science and technology development

- Earth and space science – research and instrument development
- National Center for Advanced Manufacturing – sophisticated materials development
- Space Optics Manufacturing Technology Center – large optics manufacturing/testing



# Marshall Manages Shuttle and Space Station Elements

## Space Shuttle – 25 years of flight

- External tank
- Main engines
- Reusable solid rocket boosters
- Reusable solid rocket motors



## International Space Station – 5 years of habitation

- Marshall responsibilities:
  - Payload Operations Center (POC) – Science management
  - Node 2 (connector module) and Node 3 (life support module)
  - Multi-Purpose Logistic Modules (MPLM)
  - Environmental Control and Life Support Systems (ECLSS)
  - Microgravity Science Glove Box
  - Space Station Furnace Facility (SSFF) science rack





# Ares I and V Launch Vehicles Built on Proven Systems

## Marshall's development tasks

- Systems engineering and integration
- Safety and mission assurance
- First stage design and upper stage engine development and contracts management
- Upper stage design, development, testing, and evaluation
- Flight testing and evaluation
- CEV, launch abort system, service module, abort test booster support

***Ares I flight tests begin in 2009***





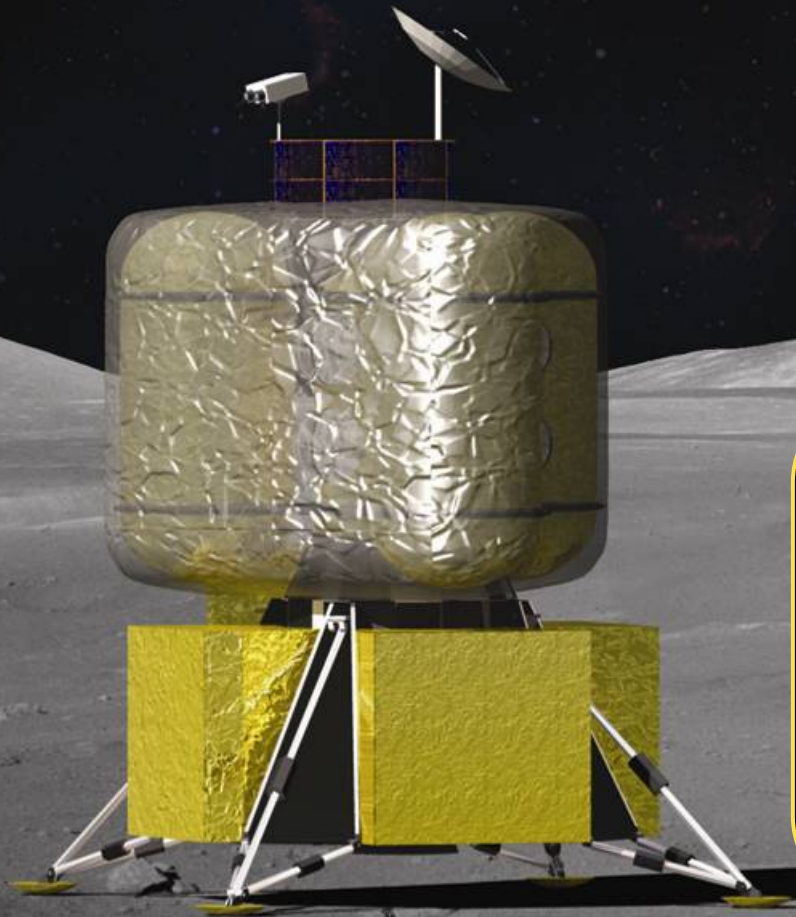
# Ares V: Developing New Heavy Lift Capability

- Early engineering underway at Marshall
- Main vehicle for reliable delivery of large payloads to the moon or beyond
- At 358 feet, almost as tall as Saturn V
- With Ares I, successor to shuttle as America's workhorse system for routine space access

*NASA's heavy lifter to help establish long-term human presence on moon*



# Paving the Way: Lunar Precursor Robotic Program



## **LRO, LCROSS, and landers to answer crucial questions**

- Evaluate landing zones
- Demonstrate precision landing
- Determine lunar resources
- Provide evolvable platform



# Landing on the Moon: Lunar Surface Access Module

## Lunar Lander Project Office

- Preliminary engineering studies
- Requirements development for descent stage
- Reports to Constellation Program





# Creating Science Platforms to Enable Discovery

- **Starting with Wernher VonBraun and Ernst Stuhlinger** – Science was important from the beginning:  
*What could be learned using the transportation infrastructure?*
- **Significant roles in major NASA science activities** – Skylab, HEAO, SpaceLab, Hubble, Compton/GRO, Chandra
- **Significant roles in smaller NASA science activities** – Solar Max, DE, Polar, IMAGE, TRMM
- **Highly specialized scientific expertise and excellence** – We don't do everything but in specialty areas we excel

Skylab



SpaceLab



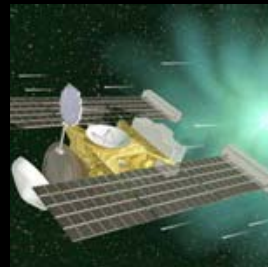
BATSE/CGRO



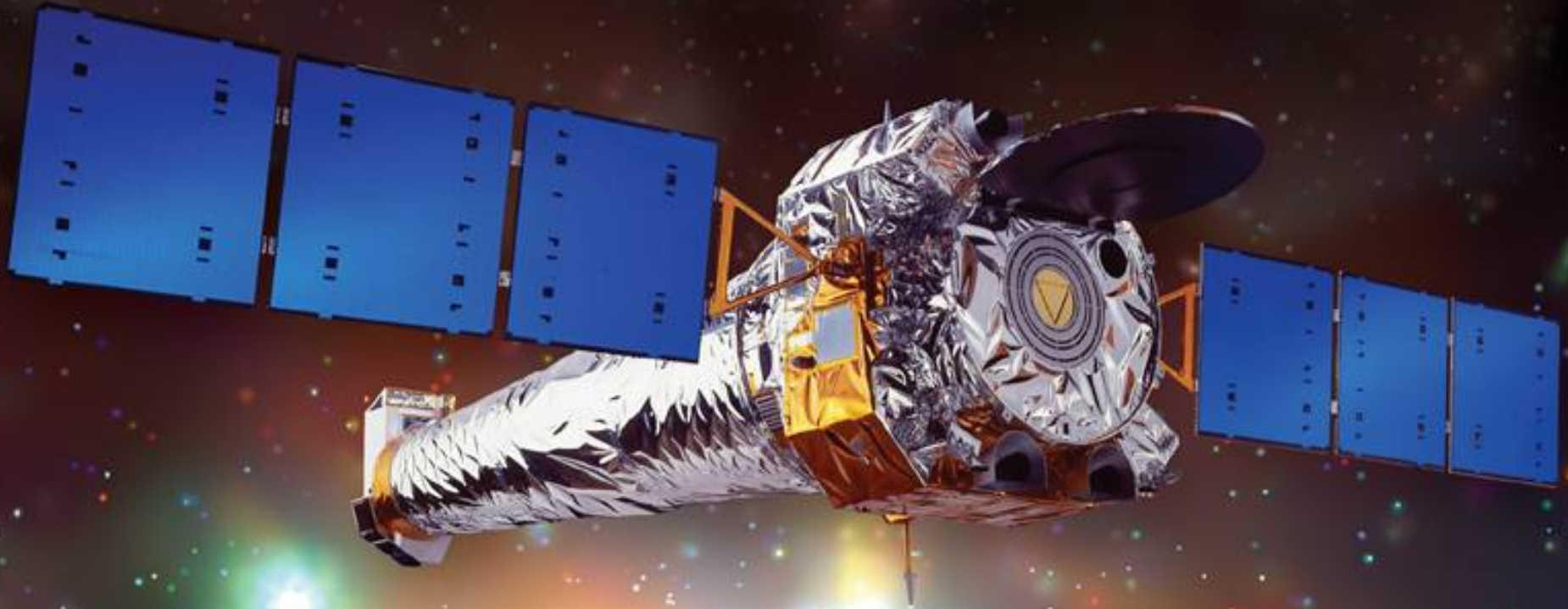
Gravity Probe B



Discovery & New Frontiers



# Exploring Our Universe



*Chandra exploring the origin, evolution, and destiny of the universe*

# Marshall Earth Science Accomplishments

- World's most comprehensive global lightning distribution maps
- Highly detailed hurricane observations
- High-altitude remotely piloted vehicle for storm research
- Information to track natural disasters and alert decision-makers in Central America
- Collaborative CDC-NASA project linking public health and environmental data
- Advances in weather prediction to speed NASA research to operational use



***Improving understanding of the Earth system to benefit society***



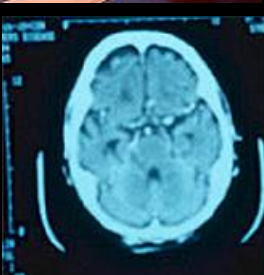
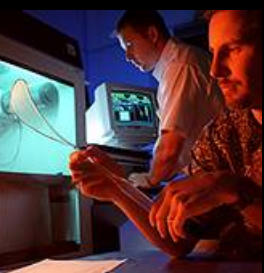
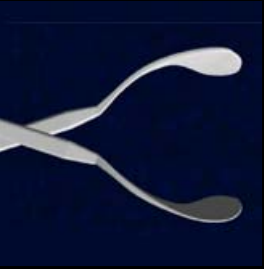
# Marshall and NASA: Improving Life on Earth

**More than 1,000 consumer products and services are built on NASA-developed technologies**

- Smoke detectors
- Solar water heaters
- Cordless tools
- Satellite-based telephone, TV, and GPS
- Many, many more ...

**Examples of technologies developed at Marshall**

- Video enhancement system for law enforcement
- Selectively lockable knee brace
- “Smart” obstetrical forceps
- Compact rescue shears
- Eye health screening system
- Powerful medical X-ray lens system





# Promoting Small Business Opportunities

## Marshall's small business achievements help assure small firm participation in center programs and projects

- Small businesses, including those with Marshall contracts, supplied 23%+ of total value of federal prime contracts in FY 05
- Marshall exceeded all NASA small business goals for 8 straight years (FY 98-FY 05; total average procurement \$1.8B)
- About one-third of Marshall's top 50 contractors (FY 05) are small businesses
- 5 small businesses ranked among Marshall's top 20 FY 05 obligations by contract (values from \$24.9M to \$8.6M)
- Promoting optimum performance: Prime Contractor Supplier Council, Business Forums, Procurement Small Business Action Team, Small Business Coordinators

***Small businesses drive community economic development***

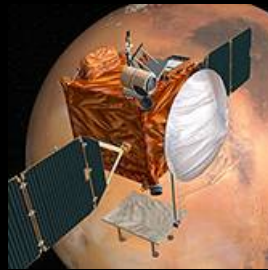


# Space Exploration Boosts U.S. Strength and Prosperity

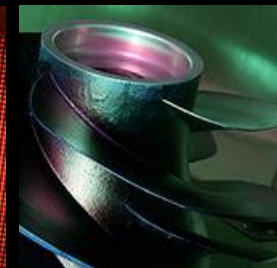
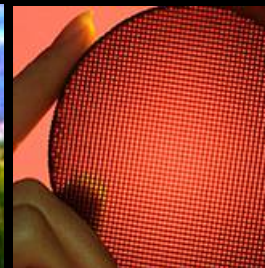
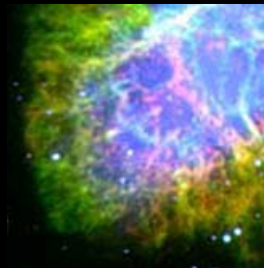
*Marshall is enabling NASA to move forward in its quest to explore, ensuring our country remains preeminent in space – crucial to national security and economic interests*



*America's drive to explore advances science, technology, society*



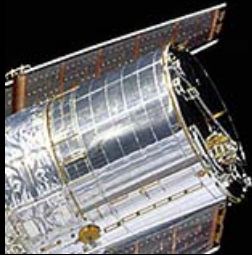
## Questions and Answers



***Visit [www.nasa.gov/centers/marshall](http://www.nasa.gov/centers/marshall) for more information***







## Backup Charts



# Marshall's Capable Workforce

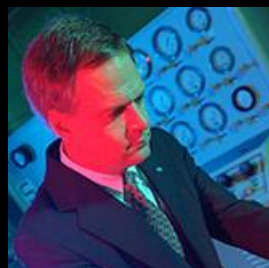
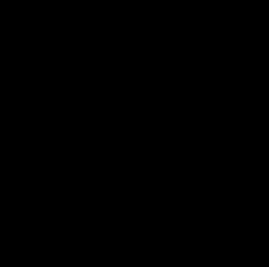
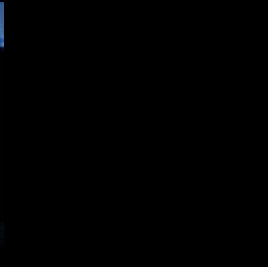
## Workforce mix (Civil Service):

- College graduates: 2,220
- Bachelor's degrees: 1,440
- Master's degrees in engineering, math, physics: 597
- Doctoral degrees: 183

## By discipline:

- Civil servants:
  - Engineers: 1,655
  - Scientists: 130
- Contractors:
  - Engineers: 1,554
  - Scientists: 18
  - G&A/business: 437

***Creative people leading space exploration***



# Ideal Technology and Business Environment

## Aerospace and defense

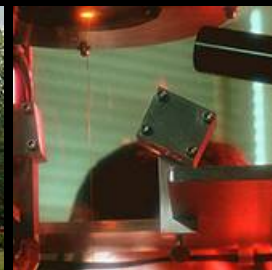
- More than 90 aerospace and defense companies employ 11,000+ people
- Virtually all major aerospace firms represented
- Ten major aerospace companies each employ 300+ people

## DoD organizations — Redstone Arsenal

- Aviation and Missile Command
- Missile and Space Intelligence Center
- Space and Missile Defense Command
- Aviation and Missile Research, Development and Engineering Center
- Program Executive Offices: Air, Space and Missile Defense; Aviation; and Tactical Missiles

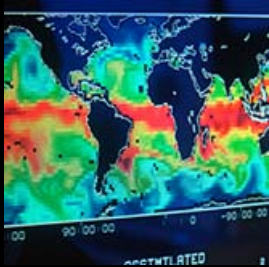
## Technology consortiums and research

- National Space Science and Technology Center
- Cummings Research Park

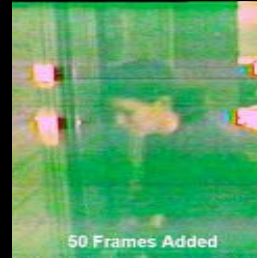


***Huntsville – major concentration of tech and defense organizations***

# National Space Science & Technology Center (NSSTC)

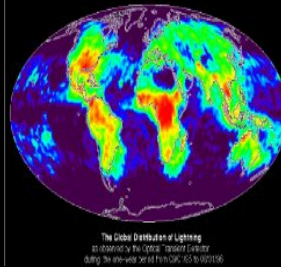


**Understanding Climatology**  
Analyzing weather patterns and their impact using satellite imaging and other data

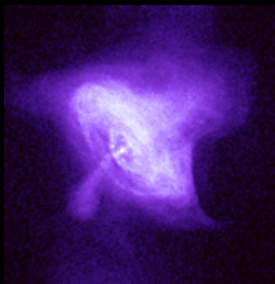
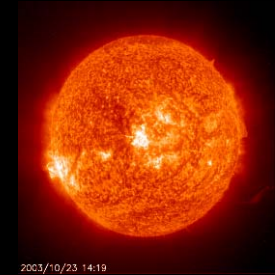


**Promoting Homeland Security**  
Enhancing images to assist law enforcement with VISAR software

**Predicting Severe Weather**  
Improving forecasting abilities using lightning, tornado, & hurricane measurements & analysis



**Protecting Spacecraft & Satellite Communications**  
Analyzing and predicting solar flares and space 'weather' with scientific instruments



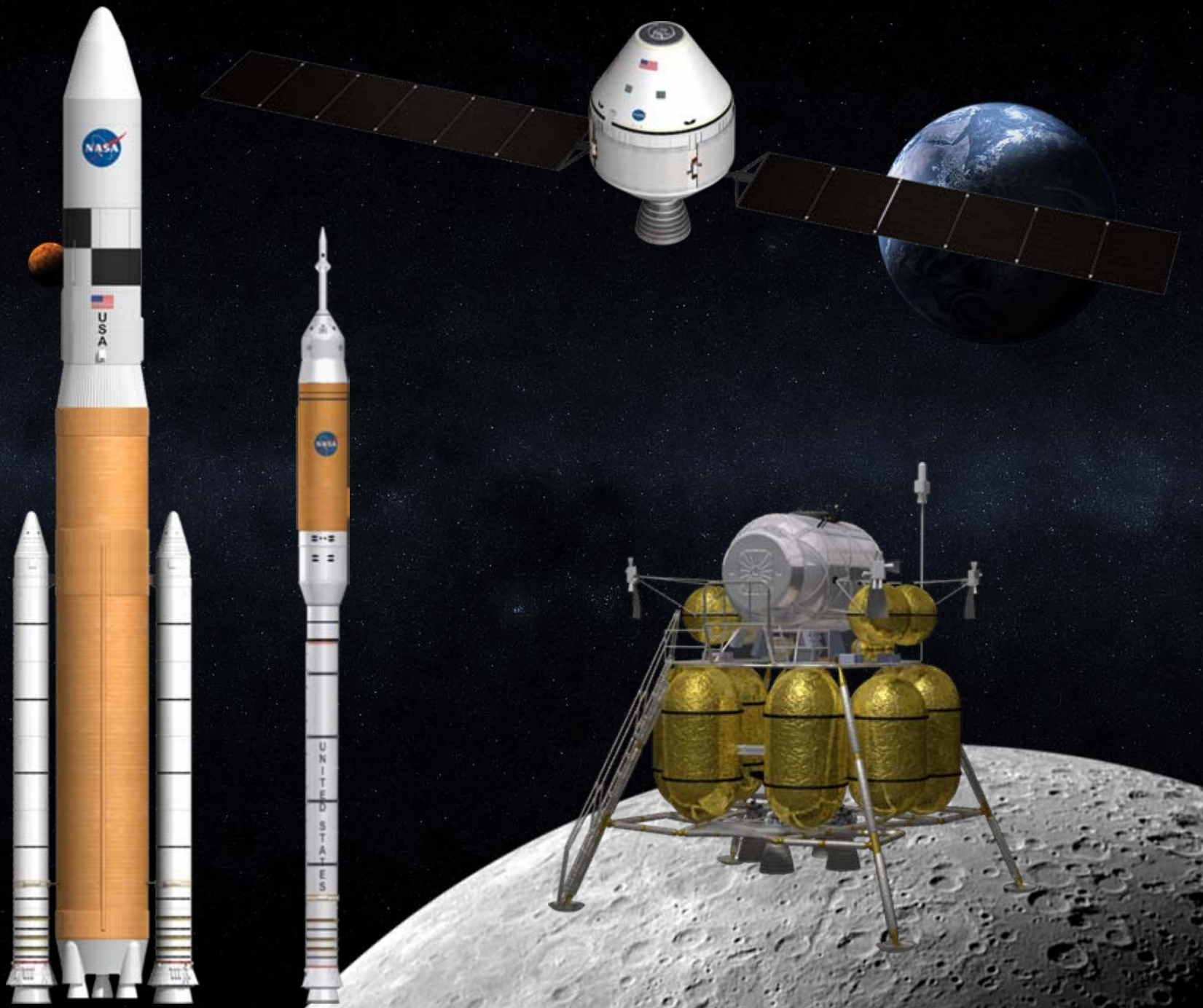
**Rewriting Our Understanding of the Universe**  
Performing cutting-edge space research that inspires the next generation



**Improving Life on Earth**  
Using remote sensing data to understand urbanization effects and other changes in land use

***Creating positive social, economic, educational, and quality-of-life outcomes through basic and applied research***





# Launch Vehicle Comparison

400

**Shuttle**  
184 ft

**Ares I**  
321 ft

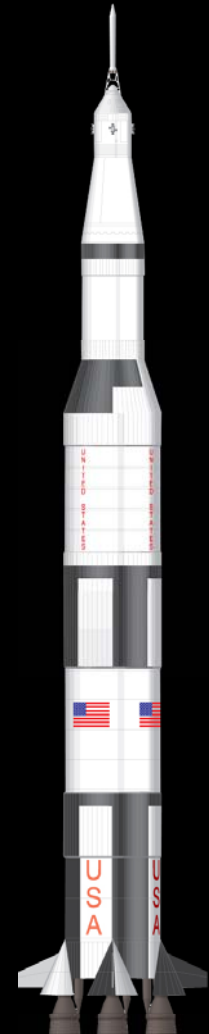
**Ares V**  
358 ft

**Saturn V**  
364 ft

300

200

100



# Leaders in the World's Scientific Community

- **Dr. Martin Weisskopf** – 2006 George W. Goddard Award, International Society for Optical Engineering
- **Dr. Jeffrey Kolodziejczak** – 2005 AIAA Oberth Award
- Marshall's four Rossi Prize recipients represent the excellence of the Center's scientific research
  - **Dr. Martin Weisskopf** - 2004
  - **Dr. Chryssa Kouveliotou** - 2003
  - **Dr. Jan van Paradijs** (UAH) - 1998
  - **Dr. Gerald Fishman** - 1994
- **Dr. Chryssa Kouveliotou** - 2003 Descartes Prize
- **Jason A. Vaughn** – 2000 Flemming Award – Applied Sciences
- **Richard Hoover** (1992), **Dr. David Hathaway** (2002) – NASA Inventors of the Year
- **Dr. Mark Christl, Dr. Tom Parnell** – 2000 Antarctica Service Medal

Weisskopf



Kouveliotou



van Paradijs



Fishman



***Creating platforms to enable scientific discoveries***



# Marshall and NASA: Investing in Education

## Why invest in education?

- Strengthen the nation's future workforce
- Strengthen and expand the K-16 science, technology, engineering, and mathematics pipeline
- Engage Americans in NASA's mission

## Marshall involvement in K-12 education

- NASA Explorer Schools (grades 4-9)
- Educator Resource Center Network
- NASA Web Portal Education Resources

## Promoting STEM in higher education

- Undergraduate and Graduate Student Research Programs
- NASA Faculty Fellowship Program
- Great Moonbuggy Race

